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09/18/03

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TITLE
Support Modeling for Rosina: from MHD to DSMC

OTHER AUTHORS
T. Gombosi, K. Hansen

☐ Premeeting publication
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Support Modeling for Rosina: from MHD to DSMC

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Support Modeling for Rosina: from MHD to DSMC.

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Rosetta Science & Comet Modeling Wrkshps

Date(s)/Location:

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Support Modeling for Rosina: from MHD to DSMC

M. Combi [(1)], *T. Gombosi* [(1)], *K. Hansen* [(1)] *et al.*

(1) University of Michigan

Abstract

The unique requirements for understanding the full range of Rosina measurements of the ROSETTA target comet during several years of both quiescent coma activity and active phases near perihelion will require a combination of fluid model simulations and kinetic/particle based model simulations. We have developed a suite of fluid and particle-kinetic models which have already been applied successfully in the interpretations and analyses a variety of spacecraft and groundbased comet measurements. We use a fluid approach for dusty-gas hydrodynamics and magnetohydrodynamics (MHD) models based on adaptive mesh refinement, which is applicable to near-nucleus active neutral coma environs and global solar wind/active comet ionosphere characterization (cometopause, bow shock/wave, flow fields), respectively. We also have a Lagrangian ion-neutral chemistry model for calculating global ion composition and the composition solar wind minor ions responsible for cometary X-ray emissions. For weak comet activity and analyzing mass-spectra of secondary superthermal neutral species, a dusty-gas Direct Simulation Monte Carlo (DSMC) is required. In the plasma regime, the global structure of weaker comet activity and small-scale microphysics requires a hybrid particle-in-cell (PIC) MHD model, which treats ions as particles and electrons as a fluid. Both test particle models in combination with the MHD as well as hybrid PIC models are required in order to understand resolved ion mass spectra and the evolution of ion distribution functions. We have begun a longer-term plan for systematically combining various model modules for more comprehensive modeling as we learn more of the needed details about 67P/Churyumov-Gerasimenko.